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EXAMINER

LI, AIMEE J

ART UNIT	PAPER NUMBER
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2183

DATE MAILED: 04/19/2004

9

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/973,429

Applicant(s)

GROCHOWSKI ET AL.

Examiner

Aimee J Li

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 27 January 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 29-42 and 44-50 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 2-42 and 44-50 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

DETAILED ACTION

1. Claims 29-42 and 44-50 have been considered. Claim 43 have been cancelled as requested.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

3. The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).
4. Claims 39, 42, and 44 are rejected under 35 U.S.C. 102(e) as being taught by Yeh et al., U.S. Patent Number 5,903,750 (herein referred to as Yeh).
5. Referring to claim 39, Yeh has taught a processor comprising:
 - a. A predicate history table to store historical information associated with a predicate (Yeh column 6, lines 55-59); and
 - b. A predicted predicate value (PPV) calculator to calculate a PPV (Yeh column 6, lines 55-59; column 7, lines 13-59; and Figure 2A).

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6. Referring to claim 42, Yeh has taught a pipeline to receive the PPV, and to conditionally execute a predicated instruction depending on the PPV (Yeh column 6, lines 55-59; column 7, lines 13-59; and Figure 2A).

7. Referring to claim 44, Yeh has taught wherein the calculator includes a selector to, based on a confidence level, select the PPV to be based on historical information (Yeh column 6, lines 55-59; column 7, lines 13-59; and Figure 2A).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 29-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yeh et al., U.S. Patent Number 5,903,750 (herein referred to as Yeh) in view of Christie, U.S. Patent Number 6,009,512 (herein referred to as Christie).

10. Referring to claim 29, Yeh has taught A method of executing a sequence of instructions comprising:

- a. Determining a predicted predicate value (PPV) for a predicate (Yeh column 6, lines 55-59; column 7, lines 13-59; and Figure 2A)
- b. Conditionally executing a predicated instruction depending on the PPV (Yeh column 6, lines 55-59; column 7, lines 13-59; and Figure 2A)
- c. Comparing the APV to the PPV (Yeh column 1, line 54 to column 2, line 17 and column 5, lines 8-17); and

- d. Flushing a pipeline if the APV and the PPV are unequal (Yeh column 1, line 54 to column 2, line 17 and column 5, lines 8-17).

11. Yeh has not explicitly taught executing a COMPARE instruction to determine an actual predicate value (APV) for the predicate. However, Yeh has taught that predication is used but not the exact details of executing predicate instructions (Yeh column 6, lines 55-59; column 7, lines 13-59; and Figure 2A). Christie has explicitly taught executing a COMPARE instruction to determine an actual predicate value (APV) for the predicate (Christie Abstract; column 3, lines 11-25; column 4, line 26 to column 5, line 32; column 10, lines 15-64; Figure 6; and Figure 11). A person of ordinary skill in the art at the time the invention was made would have recognized that through the use of predication, the wasted cycles due to conditional branch execution would be eliminated (Christie column 3, lines 22-25). Therefore, it would have been obvious to a person of ordinary skill in the art at the time this invention was made to incorporate the predicate execution unit of Christie in the device of Yeh to minimize wasted cycles.

12. Referring to claim 31, Yeh has taught wherein flushing the pipeline comprises flushing only a backend portion of the pipeline (Yeh column 1, line 54 to column 2, line 17). In regards to Yeh, flushing the instructions after the branch is the same as flushing the backend portion of the pipeline.

13. Referring to claim 32, Yeh has taught updating historical information corresponding to the predicate in a predicate history table after comparing the APV to the PPV (Yeh column 5, lines 17-24).

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14. Referring to claim 33, Yeh has taught wherein conditionally executing the predicated instruction includes executing the predicated instruction if the PPV is true (Yeh column 6, lines 55-59; column 7, lines 13-59; and Figure 2A).

15. Referring to claim 34, Yeh has taught wherein conditionally executing the predicated instruction (Yeh column 6, lines 55-59; column 7, lines 13-59; and Figure 2A). Yeh has not explicitly taught treating the predicated instruction like a no-op if the PPV is false. However, Yeh has taught that predication is used but not the exact details of executing predicate instructions (Yeh column 6, lines 55-59; column 7, lines 13-59; and Figure 2A). Christie has explicitly taught treating the predicated instruction like a no-op if the PPV is false (Christie column 3, lines 15-17). A person of ordinary skill in the art at the time the invention was made would have recognized that through the use of predication, the wasted cycles due to conditional branch execution would be eliminated (Christie column 3, lines 22-25). Therefore, it would have been obvious to a person of ordinary skill in the art at the time this invention was made to incorporate the predicate execution unit of Christie in the device of Yeh to minimize wasted cycles.

16. Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yeh in view of Christie as applied to claim 29 above, and further in view of Heuring and Jordan's Computer Systems Design and Architecture (herein referred to as Heuring).

17. Referring to claim 30, Yeh has taught flushing the pipeline. Heuring has taught executing the predicated instruction after flushing the pipeline (Heuring page 228, paragraph 3). A person of ordinary skill at the time the invention was made would have recognized that executing the predicated instruction after flushing the pipeline is needed to ensure normal

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execution of the pipeline is resumed after a misprediction has occurred. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate executing the predicated instruction after flushing the pipeline as taught by Heuring in the device of Yeh in view of Christie to ensure normal execution of the pipeline after a misprediction.

18. Claims 35-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yeh et al., U.S. Patent Number 5,903,750 (herein referred to as Yeh) in view of Heuring and Jordan's Computer Systems Design and Architecture (herein referred to as Heuring).

19. Referring to claim 35, Yeh has taught a processor comprising:

- a. A predicate history table (Yeh column 5, lines 17-24)
- b. A predicted predicate value (PPV) calculator having a first input coupled to an output of the predicate history table and a second input coupled to an output of the register file (Yeh column 6, lines 55-59; column 7, lines 13-59; and Figure 2A).
- c. Yeh has not explicitly taught a register file. Heuring has taught a register file (Heuring pages 174-175, section 4.6.2; page 200, paragraph labeled The Register File; and Figures Data Path and Register File). A person of ordinary skill in the art at the time the invention was made would have recognized that register files are necessary for data to be stored and retrieved from. The register file is faster than external and main memory and easier to access later in a process, thereby minimizing delay due to retrieving data. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to

incorporate the register file of Heuring in the device of Yeh to store and retrieve data faster.

20. Referring to claim 36, Yeh has taught:

- a. A IP select circuit having an output coupled to the predicate history table (Yeh column 4, lines 17-24);
- b. An instruction decoder having an output coupled to input of the IP select circuit and the register select circuit (Yeh column 1, lines 16-37; column 4, lines 38-48; column 5, lines 8-13).

21. Yeh has not explicitly taught a register select circuit having an output coupled to the register file. Heuring has taught a register select circuit having an output coupled to the register file (Heuring pages 174-175, section 4.6.2; page 200, paragraph labeled The Register File; and Figures Data Path and Register File). A person of ordinary skill in the art at the time the invention was made would have recognized that register files are necessary for data to be stored and retrieved from. The register file is faster than external and main memory and easier to access later in a process, thereby minimizing delay due to retrieving data. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the register file of Heuring in the device of Yeh in order to store and retrieve data faster.

22. Referring to claim 37, Yeh has taught a pipeline having a PPV input coupled to an output (Yeh column 6, lines 55-59; column 7, lines 13-59; and Figure 2A) and an actual predicate value (APV) output coupled to an input of the predicate history table (Yeh column 5, lines 17-24).

Yeh has not explicitly taught a register file. Heuring has taught a register file (Heuring pages

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174-175, section 4.6.2; page 200, paragraph labeled The Register File; and Figures Data Path and Register File). A person of ordinary skill in the art at the time the invention was made would have recognized that register files are necessary for data to be stored and retrieved from. The register file is faster than external and main memory and easier to access later in a process, thereby minimizing delay due to retrieving data. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the register file of Heuring in the device of Yeh in order to store and retrieve data faster.

23. Referring to claim 38, Yeh has not taught a device having a first input coupled to the APV output of the pipeline, a second input coupled to an output of the register file, and an output coupled to a flush input of the pipeline (Yeh column 6, lines 55-59; column 7, lines 13-59; and Figure 2A). Heuring has taught an XOR gate (Heuring page 72-73, paragraph labeled Data Transmission in the Computer). A person of ordinary skill in the art at the time the invention was made would have recognized that XOR gates are needed for data transmission, to selectively transmit certain signals between elements (Heuring page 72, beginning of paragraph labeled Data Transmission in the Computer). Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the XOR gate of Heuring in the device of Yeh in order to selectively transmit certain data signals.

24. Claims 40 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yeh et al., U.S. Patent Number 5,903,750 (herein referred to as Yeh) in view of Natarjan et al., U.S. Patent Number 5,857,104 (herein referred to Natarjan).

25. Referring to claim 40, Yeh has not taught a speculative predicate register file to store the PPV. Natarjan has taught a speculative predicate register file to store the PPV (Natarjan column

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5, lines 45-51). A person of ordinary skill in the art at the time the invention was made would have recognized that the speculative predicate value needed to be stored in order to be used in future cycles of the instruction. Therefore, it would have been obvious to a person of ordinary skill in the art at the time this invention was made to incorporate the speculative predicate register file of Natarjan in the device of Yeh to store data.

26. Referring to claim 41, Yeh has taught a pipeline to receive the PPV, and to conditionally execute a predicated instruction depending on the PPV (Yeh column 6, lines 55-59; column 7, lines 13-59; and Figure 2A).

27. Claims 45-50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Natarjan et al., U.S. Patent Number 5,857,104 (herein referred to Natarjan) in view of Yeh et al., U.S. Patent Number 5,903,750 (herein referred to as Yeh).

28. Referring to claim 45, Natarjan has taught a system comprising:

- a. Memory to store a predicated instruction (Natarjan column 4, lines 42-51 and Figure 4)
- b. A bus to transfer the predicated instruction from the memory (Natarjan column 4, lines 42-51 and Figure 4).

29. Natarjan has not taught a processor to receive the predicated instruction and to calculate a predicted predicate value (PPV) for the predicate. Yeh has taught a processor to receive the predicated instruction and to calculate a predicted predicate value (PPV) for the predicate (Yeh column 6, lines 55-59; column 7, lines 13-59; and Figure 2A). A person of ordinary skill in the art at the time the invention was made would have recognized that predicate prediction improves processor performance (Yeh column 2, lines 18-20). Therefore, it would have been obvious to a

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person of ordinary skill in the art at the time this invention was made to incorporate the predicate prediction of Yeh in the device of Natarjan to improve processor performance.

30. Referring to claims 46, 47, and 48, Natarjan has not taught:

- a. Wherein the processor comprises a predicate history table to store historical information associated with the predicate (Applicant's claim 46).
- b. Wherein the processor further comprises a pipeline to receive the PPV, and to conditionally execute the predicated instruction depending on the PPV (Applicant's claim 47).
- c. Wherein the processor further comprises a pipeline to receive the PPV, and to conditionally execute the predicated instruction depending on the PPV (Applicant's claim 48).

31. Yeh has taught:

- a. Wherein the processor comprises a predicate history table to store historical information associated with the predicate (Yeh column 6, lines 55-59).
- b. Wherein the processor further comprises a pipeline to receive the PPV, and to conditionally execute the predicated instruction depending on the PPV (Yeh column 6, lines 55-59; column 7, lines 13-59; and Figure 2A).
- c. Wherein the processor further comprises a pipeline to receive the PPV, and to conditionally execute the predicated instruction depending on the PPV (Yeh column 6, lines 55-59; column 7, lines 13-59; and Figure 2A).

32. A person of ordinary skill in the art at the time the invention was made would have recognized that predicate prediction improves processor performance (Yeh column 2, lines 18-

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20). Therefore, it would have been obvious to a person of ordinary skill in the art at the time this invention was made to incorporate the predicate prediction of Yeh in the device of Natarjan to improve processor performance.

33. Referring to claim 49, Natarjan has taught wherein the memory is main memory (Natarjan column 4, lines 42-51; column 6, lines 1-21) and the bus is a system bus (Natarjan column 4, lines 42-51; column 6, lines 1-21).

34. Referring to claim 50, Natarjan has taught wherein the memory is external memory (Natarjan column 4, lines 42-51; column 6, lines 1-21).

Response to Arguments

35. Examiner withdraws drawing objections in favor of amended drawings.

36. Examiner maintains objection to title. The title is still not indicative of the inventive concept.

37. Examiner withdraws double patent in favor of claim amendments and in favor of the filed terminal disclaimer.

38. Applicant's arguments filed 4 February 2004 have been fully considered but they are not persuasive.

39. Applicant argues in essence on pages 10 and 12 "...requires a calculator that can predict a predicate as opposed to a branch. Predicates, as opposed to branches, are not predicted to be Taken as described in Yeh on column 6, lines 56-59; column 7, lines 13-59; and Figure 2A and Natarjan on column 5, lines 45-51, but as TRUE or FALSE..." This has not been found persuasive. The prediction of Taken or Not Taken is similar to TRUE or FALSE. To determine whether a branch is Taken or Not Taken, it must determine whether the condition, or predicate,

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is TRUE or FALSE. A branch is Taken or Not Taken dependent on whether the predicate of the branch is TRUE or FALSE. Also, as shown in Yeh, the predicate prediction made is Take or Not Taken. The limitation that a predicate can only be TRUE or FALSE is not in the claim and cannot be read onto the claim due to Yeh stating that the prediction of a predicate can be Taken or Not Taken. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., that a predicate indicates TRUE or FALSE not Taken or Not Taken) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

40. Applicant argues in essence on page 11

“...determining a predicted predicate value (PPV) for a predicate, and conditionally executing a predicated instruction depending on the PPV. As argued above, these elements cannot be taught or suggested by Yeh, and are also not found, not does the Examiner claim that they should be found, in Christie...”

41. This has not been found persuasive. Yeh has taught in column 7, lines 13-59 a predicate prediction is derived and indicates whether the branch instructions are Taken or Not Taken.

Please see above for response to the previous argument.

42. Applicant argues in essence on page 11-12 “...Since the reference paragraph addresses branch prediction as opposed to predicate prediction, Heuring cannot teach or suggest the element claimed by the Examiner...” This has not been found persuasive. The branch instruction being predicted is a type of predicate instruction. There is a predicate value

associated with the branch instruction, as is displayed by the predicate prediction needed to predict a branch instruction.


Conclusion

43. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).
44. A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.
45. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Aimee J Li whose telephone number is (703) 305-7596. The examiner can normally be reached on M-T 7:30am-5:00pm.
46. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Chan can be reached on (703) 305-9712. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.
47. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

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applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

AJL
Aimee J. Li
April 19, 2004



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